Electricity and Magnetism
Physics 2220
Spring 2026

Lecture Section 002, MWF 10:00–10:50 AM in the Physics Building Room 102
Recitation sections: .206, .207, .208, .209, .210

Professor: Dr. Alex Barr
Pronouns: He, him, his
Office: Physics Building, Room 209C
E-mail: alexander.barr@unt.edu
Help Hours: Wednesdays 1:00-3:00 in my office

Welcome! As members of the UNT community, we have all made a commitment to be part of an institution that respects and values the identities of students and employees with whom we interact. UNT does not tolerate identity-based discrimination, harassment, and retaliation. Everyone should feel comfortable being their authentic self in our class. If you have any questions or concerns, do not hesitate to contact me.

Communication: This is a face-to-face class with no Zoom component. All course materials (handouts, lecture slides, etc.) and announcements will be posted on Canvas. You can contact me via email at alexander.barr@unt.edu or by sending a message in Canvas. In most cases, you can expect to receive a response within 24 hours. You are also always welcome to come by my office during office hours or at other times. **You are expected to check your UNT email and Canvas messages at least once a day**.

Course Objectives: This course will cover electric fields, direct-current and alternating-current circuits, magnetic fields and magnetic induction, electric and magnetic properties of matter, and electromagnetic waves. Students will learn how to:

- Calculate the electric field and electric potential of point charges and continuous charge distributions
- Calculate the magnetic field from continuous current distributions
- Apply Newton's laws and conservation of energy and momentum to problems involving electric charges and current-carrying wires
- Explain the meaning and application of the integral form of Maxwell's equations
- Analyze simple AC and DC circuits involving resistors, capacitors, and inductors

PHYS-2220 contributes to the following core course learning objectives:

- **Critical Thinking:** Creative thinking, analysis, evaluation, and synthesis of information
- **Communication:** Development, interpretation, and expression of ideas through written, oral, and graphical means
- **Quantitative Skills:** Manipulate and analyze data to reach meaningful, informed conclusions
- **Teamwork:** Consider different points of view and work effectively with others to support a shared purpose or goal

Course Pre-requisites: Students must complete PHYS-1420 (General Physics II) or 1710 (Mechanics) or 1510 (General Physics I with Calc) with a C or better before enrolling in this course. MATH-1710 (Calc II) or 1830 (Calc for Sci and Eng III) must be completed or can be taken concurrently with PHYS-2220.

Textbook and Online Homework System: The recommended textbook is *University Physics,* 15th Edition, by Young and Freedman. Other calculus-based introductory physics textbooks are acceptable including the free OpenStax University Physics II online textbook. You are required to obtain access to the Mastering Physics online homework system. **If you took PHYS-1710 at UNT and purchased the 24 month Mastering Physics access, that same access will still be good for PHYS-2220 and you do not need to buy anything new.**

Options available through the UNT bookstore:

- 24-month Mastering Physics access including access to the e-textbook ~ $190
- 18-week Mastering Physics access including access to the e-textbook ~ $110

Attendance and Participation: You are expected to attend and participate in all lectures and recitations for the section in which you are enrolled if you are healthy**.** Lectures will frequently involve clicker questions for points. Recitations will frequently involve quizzes or group activities that cannot be made up if you are absent. If you know that you will miss an upcoming class, let the instructor know as soon as possible to see what arrangements can be made.

Homework: All homework will be posted and submitted online using Mastering Physics. Mastering Physics allows 6 submission attempts for each problem. Homework is intended to be practice, so there is no penalty for an incorrect answer as long as you arrive at the correct answer in 6 attempts or less. At the end of the semester, everyone's grade will be computed twice: once with homework included and once with homework omitted (and exams weighted more heavily). Each student will receive whichever grade is higher for them.

Late Homework: There is a 5% deduction per day that homework is late. Students can request a 72-hour homework extension using the link on Canvas to avoid the late penalty.

Mastering Physics Instructions: Go to our Canvas page and click Access Pearson on the left-hand side then click the Open Pearson icon. If you have already paid for access to Mastering Physics, use the same username and password from last semester to log in. If you do not have a username and password, you can set that up and enter your access code (from the bookstore). If you do not yet have an access code, you can still create your account and access the homework for two weeks before you are forced to purchase an access code. Here are video instructions from Pearson.

Exams: There will be three, unit exams given during class in the lecture classroom at the dates indicated on the schedule at the end of the syllabus. There is also a **comprehensive final exam during Finals Week** which will also take place in the lecture room. Exam questions will involve both mathematical calculations and conceptual explanations and will be based on material from lectures, recitation, and homework assignments.

- **There are no make-up exams.** If you miss one exam for an acceptable reason, your final exam score will be used for your missing exam score. Missing more than one exam may result in a grade of incomplete.
    - **Acceptable absences** for an exam include school-sanctioned events with an accompanying university letter, documented illness, legal or traffic emergency.
    - If you wake up sick, you must email the instructor before the exam begins to explain your absence. If you do not contact the instructor before the exam, a doctor's note will be required for the absence to be deemed acceptable.
- Questions pertaining to the grading of exams must be directed to the instructor in writing within one week of receiving your graded exam.
- If you have a pre-scheduled commitment that conflicts with one of the exams, contact the instructor as soon as possible to see if it is possible to take that exam with a different section of the class.
- **Anyone found cheating on an exam will receive an automatic zero on the exam.**

Physics Resource Center: Physics tutors are available to provide help throughout the week in **Hickory Hall 266.** This is a free service and does not require any reservations or prior planning - just drop in. There is plenty of seating and computers in so you can go there to work on your homework and have tutors available nearby if you get stuck.

Learning From Mistakes: Learning necessarily involves making mistakes. If you never make mistakes, then you are not being sufficiently challenged. The goal is to make most of your mistakes on the homework and during in-class practice so that you can ask questions and learn from those mistakes before you get to the exam. When you make a mistake on an exam, your goal is still to understand what you did wrong and to learn from that mistake for future exams.

Opportunities to practice and demonstrate your skills:

- In-class practice
- Homework
- Recitation
- Unit Exam
    - Your unit exam score can replace one recitation score from the corresponding unit
- Final Exam
    - If your final exam score is higher than one or more of your unit exam scores, those unit exam scores will be replaced with a weighted average 0.4*(original exam score) + 0.6*(final exam score)
    - If your final exam score is lower than your lowest unit exam score, your final exam score will be replaced with a weighted average 0.4*(final exam score) + 0.6*(average unit exam score)

Course Grades: Course grades will be calculated as follows

iClicker	3%
Pre-Lectures	5%
Homework	10%
Recitation	10%
Unit Exams (3)	15% each
Final Exam	27%

Exams scores will not be curved. Semester grades will be rounded to the nearest percent: >= 90% = A, 80-89% = B, 70-79% = C, 60-69% = D.

Lab Credit: You must enroll separately in Physics 2240 for laboratory science credit.

PHYS-2220 Goals and Learning Strategies: The goals of instruction in Physics-2220 are to guide you to understand and apply the fundamentals of elementary electromagnetism, and to develop your analysis skills using the mathematical tools of algebra and calculus. To help in achieving these goals you are encouraged to pursue the following strategies:

- Complete the Pre-Lecture notes and quiz prior to class. As you read, write down questions to bring with you to class.
- Come to class prepared - bring a pen and paper to take notes and a calculator for in-class problem solving.
- During class, listen, observe, take notes, attempt each problem yourself, discuss with peers, ask questions, be willing to make mistakes and volunteer tentative ideas during class discussions.
- Summarize the main ideas from class aloud or in writing within 24 hours of class.
- Set your notes and textbook aside while working on homework. Review your book or notes when you get stuck, but then put them aside again and try to solve the problem on your own.
- Email the instructor, visit office hours, and utilize the Physics Resource Center when you have questions.
- Form a study group with classmates. Meet weekly to work on homework together, not just the night before an exam.
- Work extra problems from the learning goals or end-of-the-chapter problems in the textbook.

Course Evaluation: The Student Perceptions of Teaching (SPOT) is a requirement for all organized classes at UNT. This short survey will be made available to you on-line at the end of the semester and will provide you with an opportunity to provide feedback to your course instructor. SPOT is considered to be an important part of your participation in this class. You will receive an email from "UNT SPOT Course Evaluations" from no-reply@iasystem.org with the survey link. You will have separate SPOT evaluations for lecture, recitation, and lab. During fall and spring semesters SPOT surveys are open to students to complete two weeks prior to final exams.

Use of AI and Other Technologies: The use of computing tools such as **Desmos** or **WolframAlpha** to help you solve equations or compute integrals on homework is perfectly acceptable and can help you focus on the physics rather than getting bogged down in calculations. Using any AI tools to solve homework problems is strongly discouraged (this will not prepare you to solve problems yourself on exams). Some students do find it useful to use AI to create additional practice problems when studying for exams or to summarize an example from class or a section of the textbook that is unclear.

UNT Policies

Academic Integrity Standards and Consequences: According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

ADA Accommodation Statement: UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time; however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website at disability.unt.edu.

Emergency Notification & Procedures: UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Canvas for contingency plans for covering course materials.

Sexual Assault Prevention: UNT is committed to providing a safe learning environment free of all forms of sexual misconduct, including sexual harassment sexual assault, domestic violence, dating violence, and stalking. Federal laws (Title IX and the Violence Against Women Act) and UNT policies prohibit discrimination on the basis of sex and therefore prohibit sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking, and/or sexual assault, there are campus resources available to provide support and assistance. UNT's Survivor Advocates can assist a student who has been impacted by violence by filing protective orders, completing crime victim's compensation applications, contacting professors for absences related to an assault, working with housing to facilitate a room change where appropriate, and connecting students to other resources available both on and off campus. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-565- 2648. Additionally, alleged sexual misconduct can be non-confidentially reported to the Title IX Coordinator at oeo@unt.edu or at (940) 565 2759.

TAMS Students: The Texas Academy of Mathematics and Science (TAMS) administration has made the followings statement and has asked us to include it in our syllabus for members of the Academy:

Class attendance and participation is required. Students must be alert, attentive, energetic, and eager to learn. Students who exhibit disruptive behavior or show disrespect to a teacher in the classroom are subject to severe disciplinary sanctions. The Academy does not authorize absences from class. Students must report all absences to the Academic Office within 36 hours of the absence by completing a form in the Academic Office. A student will be assessed 5 disciplinary points for each class absence, unless the absence can be justified. Faculty will also be reporting absences to the Academic Office. A student will be assessed 15 disciplinary points for failure to report an absence that is reported by a faculty member.

Tentative Lecture Schedule

Class	Date	Day	Topic	What's Due
1	12 Jan	M	Ch 21: Electric charges, Coulomb's law	
2	14 Jan	W	Ch 21: Electric field	Pre-Lecture 1 – E field
3	16 Jan	F	Ch 21: E field of continuous charge distributions	
X	**19 Jan**	**M**	**MLK JR DAY (No Classes)**	
4	21 Jan	W	Ch 22: Electric flux, Gauss's law	Pre-Lecture 2: Flux & Gauss HW 1 – C's law, E field
5	22 Jan	F	Ch 22: Applications of Gauss's law	
6	26 Jan	M	Ch 22: Conductors in electrostatic equilibrium	Pre-Lecture 3: Voltage, electric PE

7	28 Jan	W	Ch 22: Electric potential, Work, Electric PE	HW 2 – Gauss's law, conductors
8	30 Jan	F	Ch 23: Electric potential of continuous charge distributions	
9	2 Feb	M	Ch 23: Equipotential surfaces, Energy in capacitors	Pre-Lecture 4: Capacitors
10	4 Feb	W	Ch 24: Dielectrics, capacitor networks	HW 3 – Electric potential, work, U
11	6 Feb	F	Ch 24: Dielectrics, capacitor networks (continued)	
12	9 Feb	M	Ch 25: Current, resistance, Ohm's law	Pre-Lecture 5: Current & resistance
13	**11 Feb**	**W**	**Unit 1 Exam Chapters 21-23, HW 1-3**	HW 4 – Capacitors (Unit 2)
14	13 Feb	F	Ch 25: Electric power, resistor networks	
15	16 Feb	M	Ch 26: Kirchoff's laws	Pre-Lecture 6: Shorts & bulbs
16	18 Feb	W	Ch 26: Kirchoff's laws (continued)	HW 5 – DC circuits
17	20 Feb	F	Ch 26: RC circuits	
18	23 Feb	M	Ch 26: RC circuits (continued)	Pre-Lecture 7: Magnetic force
19	25 Feb	W	Ch 27: Magnetic force on particles/wires	HW 6 – RC circuits
20	27 Feb	F	Ch 27: Magnetic moment, torque on current loops	
21	2 Mar	M	Ch 28: Gauss's law for magnetism, Ampere's law	Pre-Lecture 8: Magnetic fields
22	4 Mar	W	Ch 28: Ampere's law (continued)	HW 7 – Magnetic force
23	6 Mar	F	Ch 28: Flex day	
X	**9 Mar**	**M**	**Spring Break**	
X	**11 Mar**	**W**	**Spring Break**	
X	**13 Mar**	**F**	**Spring Break**	
24	16 Mar	M	Ch 2X: Unit 2 review	Pre-Lecture 9: Survey
25	**18 Mar**	**W**	**Unit 2 Exam Chapters 24-27, HW 4-7**	HW 8 – Magnetic fields (Unit 3)
26	20 Mar	F	Ch 29: Lenz's law	
27	23 Mar	M	Ch 29: Faraday's law	
28	25 Mar	W	Ch 30: Inductance, RL circuits, energy in magnetic field	HW 9 – Inductance
29	27 Mar	F	Ch 30: LC and RLC circuits	
30	30 Mar	M	Ch 31: AC circuits – power and impedance	Pre-Lecture 11: AC basics
31	1 Apr	W	Ch 31: AC circuits – phase shift and resonance	
32	3 Apr	F	Ch 31: Transformers	
33	6 Apr	M	Ch 33: Maxwell's equations and EM waves	
34	8 Apr	W	Ch 34: Refraction	HW 10 – RL, LC, AC circuits
35	10 Apr	F	Ch 34: Flex day	

36	13 Apr	M	Ch 3X: Unit 3 review	
37	**15 Apr**	**W**	**Unit 3 Exam Chapters 28-31, HW 8-10**	

38	17 Apr	F	Ch 34: Thin lenses	
39	20 Apr	M	Ch 35: Light waves and interference	
40	22 Apr	W	Ch 35: Light waves and interference	
41	24 Apr	F	Ch X: Magnetism as a relativistic phenomenon	
42	27 Apr	M	Review	
43	29 Apr	W	Review	HW 11 – Light
X	**1 May**	**F**	**Reading Day (No Classes)**	

Comprehensive Final Exam: Saturday, May 2nd 7:30-9:30 am in PHYS-102